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# ANTIDIABETIC ACTIVITY OF ETHANOLIC EXTRACT OF *MIRABILIS JALAPA* ROOTS

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**ABSTRACT**

Diabetes mellitus often referred to simply as diabetes—is a condition in which the body either does not produce enough, or does not properly respond to, insulin, a hormone produced in the pancreas. This study was designed to investigate the anti-diabetic activity of an ethanolic extract of the root of *Mirabilis jalapa* which is widely being used in Himalayan region as a traditional treatment for diabetic mellitus. Ethanolic extract of *Mirabilis jalapa* (EEMJ) (10mg/kg & 20mg/kg) were administered as a single dose per day to the streptozotocin-induced diabetic rats for 12 days. Ethanolic extract of *M. jalapa* root was found to lower blood glucose significantly. The ethanolic extract was also found to reduce the increased level of triglycerides, total cholesterol and LDL-cholesterol. The present investigation of the plant established pharmacological evidence to support the folklore claim that is an antidiabetic agent.

**Keywords:** *Mirabilis jalapa,* Streptozotocin, Antidiabetic, Hypoglycemic effect, Blood Glucose, roots.

## INTRODUCTION

Herbal medicine is the oldest form of healthcare known to mankind. Herbs had been used by all cultures throughout history. Herbal medicine, also called botanical medicine or phytomedicine, refers to the use of a plant's seeds, berries, roots, leaves, bark, or flowers for medicinal purposes. Long practiced outside of conventional medicine, herbalism is becoming more main stream as improvements in analysis and quality control along with advances in clinical research show their value in the treatment and prevention of disease [1]. The use of medicinal plants in the treatment of disease was conceived by tribal people thousands of years ago.

Many tribal groups have been using several plant or animal product for medicinal preparations and these medicine are known as Ethno medicine. Generally, tribal groups utilize local herbs for different ailment after centuries of trials by using various plants parts for medicinal preparation [2].

Diabetes mellitus often referred to simply as diabetes—is a condition in which the body either does not produce enough, or does not properly respond to, insulin, a hormone produced in the pancreas. Insulin enables cells to absorb glucose in order to turn it into energy. In diabetes, the body either fails to properly respond to its own insulin, does not make enough insulin, or both. This causes glucose to accumulate in the blood, often leading to various complications. Symptoms include frequent urination, lethargy, excessive thirst, and hunger. The treatment includes changes in diet, oral medications, and in some cases, daily injections of insulin [3, 4, 5].

Insulin plays a key role in glucose homeostasis along the side of a counter regulatory hormone, glucagon, which raises serum glucose. Carrier proteins (GLUT 1- 5) are essential for glucose uptake into cells. In general, insulin therapy has been considered to be the last therapeutically option when diet, exercise and oral anti hyperglycaemic agent therapies have failed. Oral agents are used in diabetic patients who fail to meet glycaemia goals with medical nutrition therapy and exercise. Traditionally plants are also used for the treatment of diabetes throughout the world. Management of diabetes without any side effect is still a challenge for the medical system. This leads to an increasing search for improved antidiabetic drugs [6].

In the recent past many hypoglycaemic agents are introduced, still the diabetes and the related complications continue to be a major medical problem not only in developed countries but also in developing countries. Many Indian medicinal plants are reported to be useful in diabetes. However, search for new anti-diabetic drugs is continued [7, 8].

*Mirabilis jalapa* belongs to the family Nyctagineceae. It is a perennial herb that reaches a height of 50-100 cm from a tuberous root. Some cultivated hybrid can grow up to a meter in height. It is a popular ornamental plant grows worldwide for the beauty of its flowers which can be white, red, pink, purple or multi coloured and their sweet fragrance. *Mirabilis jalapa* has been used in traditional medicine [2] which may be due to presence of some bio molecules of pharmacological importance [9].

According to our best knowledge the Antidiabetic activity of *Mirabilis jalapa* So in the present study, the root of plant *Mirabilis jalapa* Linn has been investigated for its medicinal values as the potential hypoglycemic and hypolipidemic effect in Streptozotocin-induced Hyperlipidemia and Insulin Resistance in Rats.

## MATERIAL AND METHOD

### Plant material

The plant material *Mirabilis jalapa* root was collected in the month of September-October from local areas of Sikkim Himalayan region of lower hills in a high altitude. The plant species were identified with the help of standard literature [10] and they were authenticated at Botanical survey of India, Gangtok, Sikkim.

### Extract preparation

About 700 gm of the air-dried powdered plant material was extracted by continuous hot percolation method in Soxhlet apparatus with different solvents, starting from petroleum ether (60-80°c) followed by benzene, chloroform, acetone and methanol. Each time before extracting with the next solvent, the powdered material was air dried below 50°C each extract was concentrated by distilling off the solvent and evaporating to dryness on water bath. The extracts were then subjected for phytochemical screening [11]. The ethanolic extract (yield 2.0828%) was investigated for its pharmacological consequence [12].

### Animal

Twenty four healthy Wister albino rats of either sex weighing 100 ± 20 g were divided into 4 groups of 6 animals each. The animals were housed under standard conditions and room temperature (25 ± 2° C) was controlled. All animals were fed with standard rat pelleted diet and had free access to tab water *ad libitum.* The study has got the approval from the Institutional Animal Ethical Committee (IAEC) of Committee for the Purpose of Control and supervision of experiments on Animals (CPCSEA).

### Acute toxicity study

As the result for acute toxicity study was already has been reported, hence the obtained result is been used [13]. From the reported literature, it has been found that the no mortality or any signs of behavioral

changes or toxicity observed after oral administration of the ethanolic extract of roots up to the dose level of 3000mg/kg bodyweight in rats.

**Induction of diabetes by streptozotocin**

Diabetes was induced in overnight fasted rats by a single intraperitoneal injection of freshly prepared streptozotocin (STZ) 60mg/kg body weight in 0.1M citrate buffer (pH 4.5) in a volume of 1ml/kg body weight. Diabetes was confirmed in the STZ-treated rats by measuring fasting blood glucose concentration 72 hours after STZ injection. Rats with fasting blood glucose of more than 200mg/dl were considered diabetic and included in the study after a stabilization period of 7 days [14].

**Experimental design**

The rats were divided into four groups of six rats each. Group 1 was STZ-induced diabetic control, 3 and 4 were STZ-induced diabetic rats respectively administered 10 and 20mg/kg body weight ethanolic root extract of *M. jalapa* for 12 days, and group 2 was STZ-induced diabetic rats given daily glibenclamide (1mg/kg body weight) for the same duration. Extract and glibenclamide were administered by using feeding needle. Normal or controls were administered equivalent volume of distilled water for the 12 days.Fasting blood glucose levels were estimated on days 0, 5 and 12. Blood samples were collected by end tail method and blood glucose level was determined by using one touch electronic glucometer using glucose strips.

At the end of day 12, blood samples were collected retro-orbital from the inner canthus of the eye under light ether anaesthesia using capillary tubes. Blood was collected into fresh vials containing anticoagulant and serum was separated in a centrifuge at 2000 rpm for 15 min. Serum of the blood sample was undertaken for total cholesterol, triglycerides, HDL-cholesterol and LDL-cholesterol analysis using Semi Auto Analyser (Merck ML-300).

**Statistical analysis**

All the data were statistically evaluated by use of one-way ANOVA, followed by Dunnett-Multiple Comparisons Test. The values were considered significant when $p<0.05$ [15].

## RESULTS

**Phytochemical study:** Table-I represents the Physical properties (Color, Consistency and Extractive values) of Successive solvent extracts was carried out and the results are presented in. The aqueous extract sowed the highest (3.09%) extractive value where as the ethyl acetate extract sowed the lowest (0.13%) extractive value. Table-II represents the various phytoconstituents present in the concentrated extracts. The Petroleum Ether extract contained alkaloids, Benzene extract contained glycosides, phytosterols, Gums and Mucilage, Chloroform extract contained glycosides and phytosterols, Acetone extract contained alkaloids and carbohydrates, Ethyl acetate extract contained alkaloid, carbohydrates and glycoside, Methanol extract contained alkaloids, carbohydrates and phytosterols, Ethanol extract contained alkaloids, carbohydrates and phytosterols, Water extract contained alkaloids, carbohydrates and phytosterols.

**Table-I: Successive Solvent Extractive Values and Nature of Extracts of Root of *Mirabilis Jalapa.***

| Sl. No. | Solvent | Color | Consistency | Extractive value (%w/w) |
|---|---|---|---|---|
| 1 | Petroleum ether | Brownish –Yellow | Sticky | 0.232% |
| 2 | Benzene | Brown | Sticky | 0.268% |
| 3 | Chloroform | yellowish brown | Jelly | 0.2% |
| 4 | Acetone | Dark Brown | Semi solid | 0.2932% |
| 5 | Ethyl Acetate | Brown | Sticky | 0.134% |
| 6 | Methanol | Reddish Brown | Semi solid | 2.368% |
| 7 | Ethanol | Dark Brown | Semi solid | 2.0828% |
| 8 | Water | Brown | Semi Solid | 3.0987% |

**Table-II: Preliminary Photochemical Analysis of Root of *Mirabilis Jalapa.***

| Test | P | B | C | A | EA | M | E | W |
|---|---|---|---|---|---|---|---|---|
| **Alkaloids** | + | – | – | + | + | + | + | + |
| **Carbohydrates** | _ | – | _ | + | + | + | + | + |
| **Glycosides** | – | + | + | – | + | – | – | – |
| **Phytosterols** | – | + | + | _ | _ | + | + | + |
| **Fixed oil and fats** | _ | _ | _ | _ | _ | – | – | – |
| **Phenolic compound and Tannins** | _ | _ | _ | _ | _ | – | – | – |
| **Saponins** | _ | _ | _ | – | _ | – | – | – |
| **Proteins and Aminoacids** | _ | _ | _ | _ | _ | – | – | – |
| **Gums and Mucilage** | _ | + | _ | _ | _ | – | – | – |
| **Flavonoid** | _ | _ | _ | _ | _ | – | – | – |
| **Coumarin** | _ | _ | _ | – | _ | – | – | – |

**Antidiabetic activity**

Antidiabetic activity revealed that the ethanolic extract of *Mirabilis jalapa* (EEMJ) roots in two dose levels was tested. A significant decreased ($p<0.01$) fasting blood glucose was observed with all dose levels in streptozotocin induced diabetic rats is represented in the Table- III. Serum lipid profile like triglycerides, total cholesterol and LDL-cholesterol were decreased in EEMJ treated test groups in diabetic rats whereas HDL cholesterol increased significantly as compared to diabetic control. From this result, it can be concluded that EEMJ shown significant antidiabetic activity in the doses of 10 and 20 mg/kg p.o. is represented in the Table-IV.

**Table-III: Effect of Ethanolic Extract of *Mirabilis Jalapa* on Diabetic Rats.**

| **Fasting Blood glucose concentration (mg/dL)** | | | |
|---|---|---|---|
| **Treatment(mg/kg p.o.)** | **Day 0** | **Day 5** | **Day 12** |
| Diabetic Control | 238.63± 6.32 | 241.42± 7.13 | 247.48± 7.10 |
| Glibenclamide 1 | 259.8± 11.63 | 129.25±10.12** | 98.51± 6.11** |
| EEMJ 10 | 298.7± 7.72 | 159.47±8.14** | 132.42± 6.16** |
| EEMJ 20 | 292.7±8.31 | 136.40± 7.12** | 118.45± 5.11** |

Values are expressed as mean ±SE, n=6. Comparison were made between the test groups and diabetic control group by One-way ANOVA followed by Dunnett-Multiple Comparisons ****** ($p<0.01$)

**Table-IV**: **Lipid Profile of Ethanolic Extract of *Mirabilis Jalapa* on Serum of Diabetic Rats.**

| | **Triglyceride** | **Total Cholesterol** | **HDL-Cholesterol** | **LDL-Cholesterol** |
|---|---|---|---|---|
| **Treatment (mg/kg p.o.)** | **Serum (mg/dL)** | **Serum (mg/dL)** | **Serum(mg/dL)** | **Serum(mg/dL)** |
| Diabetic Control | 189.35± 3.11 | 132.55±5.12 | 35.48±4.14 | 88.5±5.48 |
| Glibenclamide 1 | 108.33± 8.13** | 128.32±5.18 | 98.41±3.10** | 56.33 ± 2.65** |
| EEMJ 10 | 59.38±6.13** | 119.50± 5.19 | 105.25±7.09** | 70.83 ± 3.73* |
| EEMJ 20 | 56.28±8.14** | 86.53±5.16** | 117.48±7.16** | 68.66 ± 4.05** |

Values are expressed as mean ±SE, n=6. Comparison were made between the test groups and diabetic control group by One-way ANOVA followed by Dunnett-Multiple Comparisons **** ($p<0.01$)

**DISCUSSION**

*Mirabilis jalapa linn* belonging to the family Nyctagenaceae is one of the important medicinal plants.The incessant treatment of the extracts of *M. jalapa* for a period of 12 days produced a significant reduce in the blood sugar levels of diabetic rats. The standard drug, Glibenclamide has been used for many years to treat diabetes, to stimulate insulin secretion from pancreatic $\beta$ -cells. The possible mechanism by which root brings about a decrease in blood sugar level may be by potentiating of the insulin effect of plasma by increasing either the pancreatic secretion of insulin from $\beta$-cells of the islets of langerhans or its release from the bound form. A number of other plants have been reported to exert hypoglycaemic activity through insulin release-stimulatory effects. These results confirmed the use of *M. jalapa* root in traditional system of medicine to treat diabetes in India. Further comprehensive chemical and pharmacological investigations are necessary to elucidate the exact mechanism of the hypoglycaemic consequence of *M. jalapa* root. The phytochemical investigations suggest that the ethanolic extract of the *M. jalapa* root contain alkaloids. So the activities may be due to the alkaloids. Further investigations are needed for better understanding of molecular mechanism of action and signal transduction of the components present in ethanolic extract of *M. jalapa* regarding antidiabetic activity.

**CONCLUSION**

The experimental evidence obtained in the present laboratory animal study indicates that, the ethanol extract of *Mirabilis jalapa* roots possesses hypoglycemic property. *Mirabilis jalapa* roots extract could serve as a useful supplementary therapy in diabetic disease. Thus, the present study confirmed the antidiabetic efficacy of this plant used in traditional folk medicine.

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